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Gentlemen:

RECOMMENDED STANDARD FOR OCCUPATIONAL EXPOSURE TO NICKEL AND INORGANIC NICKEL COMPOUNDS

Edward J. Vallario's letter of November 12 requested that we review the technical merits of the proposed standard and inform you of any significant problems which we would have in complying with the standard. Our comments are limited to brief discussions of the impact upon our operations, health protection measures, exposure limits, carcinogenicity, and air sampling procedures.

At GAT, employees may be exposed to aerosols containing nickel during the welding of nickel-containing metals, use of nickel-based welding electrodes, nickel metallizing processes, grinding of materials which contain nickel, and electroless nickel plating of steel parts. The most serious employee exposures occur during the nickel metallizing process and welding operations. Both generate nickel oxide fumes. When nickel fume concentrations in an employee's breathing zone exceed either the 1975 ACGIH Threshold Limit Value (TLV) of 1 mg/m^3 or the Short Term Excursion Limit of 3 mg/m^3, GAT requires the use of approved respiratory protection until feasible engineering controls such as local exhaust ventilation can be installed. Respiratory protection is currently used for nickel metallizing, MIG nickel welding, and welding in enclosed spaces. The nickel fume concentrations range from 2 mg/m^3 for MIG nickel welding to 6 mg/m^3 for nickel metallizing. Even though we are able to keep the time-weighted average exposures to nickel fumes below 0.5 mg/m^3, 50% of the TLV, a reduction in the TLV by several orders of magnitude (1 mg/m^3 to 5 $\mu g/m^3$) would have a dramatic impact upon our operations.

 9803,4.3

The draft document defines "occupational exposure to nickel as work in an area where nickel is processed, stored, handled, or otherwise used, and where exposure to airborne concentrations of nickel dust, fumes, or mist is likely to occur." (lines 22-25) At GAT, approximately 600 employees could be considered as occupationally exposed to nickel. Fifty percent of these workers are exposed to nickel aerosol concentrations which are greater than the proposed limit of 5 $\mu g/m^3$. The 8-hour, time-weighted average nickel fume concentrations in the X-700 Converter Fabrication Shop and the X-720 Weld Shop are 20 $\mu g/m^3$ and 10 $\mu g/m^3$ respectively. Therefore, most employees working or visiting in these shops could receive exposures which are in excess of the proposed environmental limit. Data collected from our aerosol sampling program and research sponsored by the American Welding Society (AWS) indicate that nickel fume concentrations in the welder's breathing zone should exceed 5 $\mu g/m^3$ during most welding operations which involve the use of nickel-containing metals or nickel-based welding electrodes. Additional AWS studies have shown that nickel fume concentrations in the welder's breathing zone can be higher than the recommended environmental limit during the use of electrodes which contain only trace quantities of nickel. Furthermore, nickel fume concentrations generated by scarfing operations during our process cell equipment change-out program usually exceed the environmental limit proposed by NIOSH.

If enacted, the standard would require GAT to "control airborne nickel in the workplace so that no employee is exposed to nickel at airborne concentrations greater than 5 $\mu g/m^3$, determined as a two-hour sample." Since the use of nickel and nickel-based materials can not be halted, everyone working in the X-700 Converter Shop, the X-720 Weld Shop, and cell housings during change-out activities would be required to wear approved respiratory protection at all times until feasible engineering controls could be installed. As a result of this requirement, as many as 600 half-face respirators could be in use daily. The use of well maintained closed systems and the prevention of fume generation are the best methods of preventing employee exposures. Because the escape of nickel compounds into the environment of the worker is likely in most of our operations, the use of properly designed and maintained ventilation systems will be necessary to prevent the accumulation of nickel aerosols in excess of the environmental limit. Local exhaust ventilation systems would be needed at most welding stations in our X-700, X-705, and X-720 Buildings. The costs associated with the design, procurement, and installation of new ventilation systems in our welding areas would probably exceed one million dollars. While local exhaust ventilation systems are designed to efficiently remove gross quantities of airborne particulates from the working environment, they are not always successful at achieving "zero concentration" levels. Therefore, it may be necessary to design more efficient local exhaust ventilation systems.

In addition to reducing the acceptable airborne nickel particulate concentrations, the standard requires that the employer must adhere to regulations pertaining to medical surveillance, labeling and posting, personal protective equipment, training, work practices, sanitation, and environmental monitoring. Compliance with these requirements is mandatory when employees are subject to "occupational exposures." By definition of the "occupational exposure," we would have to implement these programs in all areas where nickel is processed, stored, handled, or used. As a result of these rules, eating, smoking, and resting could not be allowed in either the X-700 Converter Shop or the X-720 Weld Shop. Lunch rooms and rest areas in these buildings would have to be relocated. The carrying of cigarettes or other smoking materials would be prohibited since airborne nickel compounds are present. Coverall laundering procedures would have to be modified to prevent exposure to those handling the soiled clothing. Contaminated and uncontaminated locker rooms would be needed in our X-700 and X-720 Buildings and in all process buildings. In each work area where nickel is used, we would have to post a warning that nickel is a "cancer-suspect agent." These are only a few examples of the many changes which we would have to make in order to achieve compliance with the standard proposed by NIOSH.

We concur with the opinion of the TLV committee of the American Conference of Governmental Industrial Hygienists that the results of animal experiments designed to assess the carcinogenicity of nickel oxide are inconclusive and that the agents causing cancer in nickel workers have not yet been identified. This point of view may be best summarized by the following lines from the NIOSH document: (lines 3585-3592)

> Based on the studies presently available, it has not been conclusively shown from epidemiologic or other human studies that exposure to airborne nickel or any inorganic nickel compounds is not associated with the development of cancer of the respiratory organs. In addition, it has not been shown that nickel is not carcinogenic in animals by all routes of exposure. Based on the information available to date, NIOSH concludes that .... elemental nickel and all other inorganic nickel compounds are potential respiratory carcinogens.

Wehner et al, in 1975, reported the results of a nickel oxide inhalation study with hamsters receiving life-span exposures to a respirable aerosol of nickel oxide. The authors concluded that neither a "significant carcinogenic effect of the nickel oxide nor a cocarcinogenic effect of cigarette smoke" was found. However, in both this study and previous studies (lines 2541-2544), the test animals were exposed to nickel oxide aerosol concentrations which were several orders of magnitude higher than the

proposed limit value of 5 $\mu g/m^3$; concentrations ranged from 50-100 mg/m^3. While toxicological data indicate that nickel sulfide is a respiratory carcinogen, we feel that there is no positive evidence that nickel oxide is a carcinogenic agent. In the section of the document entitled "Research Needs for Nickel," NIOSH states that "toxicological studies are needed to assess the carcinogenicity of nickel, particularly elemental nickel and nickel oxide by chronic inhalation," (lines 3771-3773). NIOSH has apparently adopted a policy which categorizes all suspected or potential carcinogens as carcinogens until proven otherwise. While this will afford the worker the best health protection, it is not realistic to assume that industry can isolate each process or operation involving suspected carcinogens in order to insure virtually no employee contact with the potential carcinogen. We recommend that the standard classify inorganic nickel compounds as being suspect of carcinogenic potential for man. The current TLV should be re-evaluated and worker exposure by all routes should be carefully controlled to levels consistent with the animal and human experience data. NIOSH should consider the classification scheme for potential carcinogens proposed by the ACGIH and presented in the publication entitled "TLV's--Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1976."

Epidemiologic and toxicologic studies are needed to assess adverse effects on reproduction in both men and women, teratogenicity, and mutagenicity.

The air sampling techniques used at GAT are similar to those proposed by NIOSH. However, we measure the quantity of nickel present on a filter by x-ray emission spectroscopy (fluorescence) procedures which permit the determination of 0.4 µg of nickel per 37-mm mixed cellulose ester membrane filter.

Very truly yours,

GOODYEAR ATOMIC CORPORATION

C. D. Tabor
General Manager

CPB:lnr

cc: W. A. Johnson, ERDA-ORO
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C. C. Hopkins, Paducah

UNION CARBIDE

INTERNAL CORRESPONDENCE

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Date June 1, 1978
Originating Dept.
Answering letter date

Copy to T. G. Fortney
H. P. Witschi
Industrial Hygiene - RC

Subject Toxicology Studies of Inorganic Compounds

As we discussed in our meeting of May 31, 1978, OSHA is still anticipating publishing and beginning public hearings on a proposed standard for nickel compounds in late '78 or early '79. As you well know, the proposed standard will apply to all inorganic nickel compounds although there is no experimental or epidemiological data that suggests comparable toxicity of all forms of inorganic nickel. Because this standard can have a major impact on ORGDP, and in fact all Nuclear Division activities, it is essential that UCC and DOE are well prepared to respond to the proposed document during the public hearings.

Among the types of information that is still necessary is basic animal toxicity studies comparing various inorganic nickel compounds. As you know, Dr. H. P. Witschi submitted a proposal to us on March 13, 1978, outlining an inhalation toxicity study of four inorganic nickel compounds. Although this study has not yet been funded, it is necessary that we make every effort to initiate work in this general direction. For a relatively small amount, approximately $20,000, Dr. Witschi can begin a number of preparatory studies for the inhalation toxicity studies he proposed. In addition, should funding not be available for the original study, the work that could be conducted for $20,000 would provide very valuable information in its own. In addition, this information should be essentially available by late this year.

The smaller study, which would be conducted by Dr. Witschi, would be to administer four nickel compounds to rats by intratracheal instillation. The compounds to be used are metallic Ni, NiO, $NiCl_2$, and Ni_3S_2. This would provide for the comparison of elemental nickel and insoluble and soluble nickel compounds with a nickel compound for which some toxicology data exists, namely Ni_3S_2. No place else in the literature has a study of this type been conducted and is basic to determining the overall toxicology of nickel compounds. These experiments would provide preliminary information on how long nickel can be expected to be retained in appreciable amounts within the respiratory tract. In addition, it would provide for acute and subacute disposition of the materials throughout the

bodies and selective histopathology could also be conducted on each of the animals. This information is necessary for associating the specific activity the nickel compounds in the animal system. It would also provide for a considerable amound of the initial screening and dose ranging studies to be accomplished for the future inhalation toxicology studies as they are conducted.

Should you have any questions related to this study, please do not hesitate to contact me directly.

R. D. Gilmore

RDG:cyw